

CLAIMS

What is claimed is:

- 1 1. An analog front end apparatus, comprising:
 - 2 a) a transmit block coupled to transmit discrete multitone
 - 3 modulated upstream data to a subscriber line;
 - 4 b) a hybrid network coupled to the subscriber line and the transmit
 - 5 block; and
 - 6 c) a receive block coupled to the hybrid for receiving discrete
 - 7 multitone modulated downstream data from the subscriber line, wherein the
 - 8 transmit block, hybrid network, and receive block reside within a same
 - 9 integrated circuit package.
- 1 2. The apparatus of claim 1 wherein the hybrid is a first order hybrid
- 2 network.
- 1 3. The apparatus of claim 1 wherein the hybrid is tunable.
- 1 4. The apparatus of claim 1 wherein the hybrid is DC isolated from the
- 2 transmit and receive blocks of the analog front end.
- 1 5. The apparatus of claim 1 wherein the transmit block further comprises:
 - 2 i) a first interpolator coupled to interpolate the upstream data from
 - 3 a first clock rate to a second clock rate greater than the first clock rate;

4 ii) a power spectral density shaping filter coupled to shape the
5 power spectrum of the interpolated upstream data; and
6 iii) a second interpolator coupled to interpolate the shaped signal to
7 a third clock rate greater than the second clock rate.

1 6. The apparatus of claim 1 wherein the transmit block, hybrid network,
2 and receive block are fabricated on a same integrated substrate to form a
3 complementary metal oxide semiconductor (CMOS) integrated circuit.

1 7. A method comprising the steps of:
2 a) receiving a discrete multitone modulated upstream data signal
3 at a first clock rate, $c1$;
4 b) interpolating the upstream signal to a second clock rate $c2 > c1$.
5 c) processing the interpolated signal through a power shaping
6 power spectral density shaping filter;
7 d) interpolating the power shaped signal to a third clock rate $c3 > c2$;
8 and
9 e) converting the twice interpolated signal to an analog signal.

1 8. The method of claim 7 further comprising the step of pre-processing
2 the received upstream data signal to substantially eliminate even images.

1 9. The method of claim 5 wherein $c2 = 1.104$ MHz.

1 10. The method of claim 5 wherein $c3 = 35.328$ MHz.

1 11. A method comprising the steps of:

2 a) passing a composite signal containing discrete multitone
3 modulated upstream and downstream data signals through a hybrid to extract
4 the downstream data signal;

5 b) filtering the composite signal through a high pass filter having a
6 corner frequency, f_1 ;

7 c) filtering the high pass filtered signal through a low pass filter
8 having a corner frequency $f_2 > f_1$; and

9 d) converting the twice filtered downstream data signal to a digital
10 signal.

1 12. The method of claim 11 further comprising the steps of:

2 e) decimating the digital signal from a first rate c_1 to a second rate
3 c_2 , wherein $c_2 < c_1$;

4 f) filtering the decimated signal with an anti-aliasing low pass
5 filter;

6 g) decimating the anti-aliased signal to a third rate c_3 ; and

7 h) filtering the twice decimated signal with second high pass filter.

1 13. The method of claim 12 wherein $c_2 = 8.836$ MHz.

1 14. The method of claim 12 wherein $c_3 = 2.208$ MHz.